The Glass Industry
REG. U. S. PAT. OFF.

Vol. 13 OCTOBER, 1932 No. 10

Glass Plant Fuel Oil Systems

By JOHN W. ROMIG

FUEL oil is an accepted fuel for heating combustion chambers used in the manufacture of glass. The economics of high grade light fuel oils compared with gaseous fuels have been such that fuel oil became a substitute for natural gas. Producer gas, however, has maintained its low energy cost prestige in most localities. The supply of lighter fuel oils or distillates has dwindled as advances have been achieved in gasoline refining processes with the result that lower gravity and in most instances higher viscosity fuel oils are more plentiful than those in the distillate and gas oil group. Natural gas prices have not had an inclination to drop, distillates are only to be had at a premium, so the more viscous oils present a field for economic consideration.

Keeping in mind the changing sources of a fuel oil supply at attractive prices, the fuel oil system must be fitted to meet the requirements of the oil and at the same time render regardless of the viscosity equally satisfactory combustion results when applied to production. A fuel oil system should handle viscous fuel oils during cold weather and be as free from trouble as during warm weather. The oil must be unloaded promptly to avoid demurrage. It must be kept sufficiently mobile for pumping and when delivered to the burner it must be in such a fluid state that constant flow control is maintained through valves and finally it must have a sufficiently high temperature and low viscosity to allow perfect atomization in the combustion chamber.

The handling of fuel oil may be broken down into five major operations:

1. Unloading from car to storage.
2. Storing and transfer from tank to tank.
3. Delivery to service system.
4. Delivery to burners.
5. Atomizing and burning in combustion chambers.

All of the operations above are important in securing continuity of operation. Should the unloading system be improperly designed it may delay unloading to the point that demurrage or a shortage of fuel may be serious. Fuel oil of low pour point is almost impossible to unload on zero degree days unless it is heated and most tank cars are provided with steam coils suitable for heating oil so it will readily flow for unloading. In case of viscous fuel oils cars without steam coils or with defective coils are a real liability when they must be loaded during cold weather. Fig. No. 1 shows a fuel oil unloading station that embodies features that are necessary to keep winter unloading costs down and to insure a positive unloading operation whether light or heavy fuel oils are to be handled.

The equipment for the unloading station consists of an

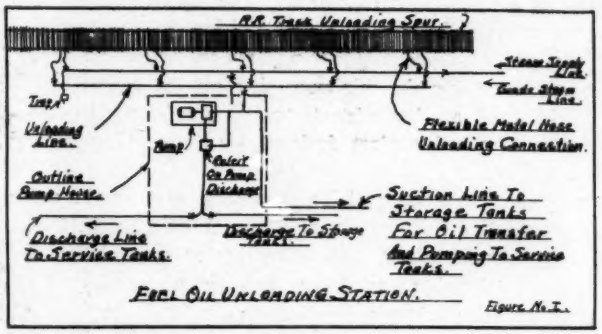


FIG. NO. 1

unloading pump of a positive suction type, a strainer, an unloading header, a steam header, bypasses and connections to the storage tank piping system. The unloading pump may be electric- or steam-driven and should have good suction characteristics so that it will handle either light or heavy oil in large volumes. An unloading pump should have a capacity so that it will unload in one day all of the cars for which unloading capacity is provided. Unloading capacity or number of places for cars depends upon whether shipments are continuous or whether they are intermittent. Space for two cars may be ample in some plants while in other plants facilities for bunched shipments with room to unload 7 or 8 cars per day may be necessary. One attendant can with ample capacity in unloading equipment unload 8 cars in the same time that it would take him to unload one car with limited facilities. There is some economic justification for high capacity unloading equipment

and bunched shipments providing that storage facilities are ample for unloading labor costs are kept low and there is a minimum amount of oil disturbance in the fuel in storage tanks.

A strainer on the unloading pump suction line guards against pump breakage that may be caused by solids entering the pump. An excess pressure relief connecting the pump discharge and the pump suction is desirable as a protection to pipe lines against excess pressure in case a positive displacement pumps are used and discharge line valves are not opened. The use of flexible metal hose between the tank car and the suction header makes a very desirable connection as considerable variation in spotting may exist without laborious pinching of cars as in the case of short double-elled connections. A steam supply for heating tank cars of viscous oil enables the system to handle high viscosity oil under all outside temperature conditions.

The next link to consider after the unloading station is the storage system. Storage capacity depends upon many factors the chief items being as follows: 1. Consumption. 2. Proximity of supplies or reliability of deliveries. 3. Economic purchasing lots, which depend upon the chance for purchase of distress fuel oil. 4. Purchasing and storing a supply of oil of constant quality to avoid frequent quality changes. Under usual market and delivery conditions a 30 days supply of fuel oil should be considered as a minimum unless contractual agreements are such that proper quality of fuel oil can be furnished direct from the source of supply as consumption demands. Then the storage capacity may be reduced to a supply that will last from two to three times as long as the shipment requires en route, such storage conditions being the minimum that can be recommended. If deliveries are inconsistent storage capacity must be sufficient to guard against fuel shortages for shortages are expensive.

In some cases very satisfactory arrangements can be made by contracting for a year's requirements for a specified fuel oil in advance—demanding shipments as consumption demands but keeping a minimum stock for emergencies. This purchase scheme has such advantages as having a constant source of supply of a fuel of certain specifications in addition to the economic advantage of low inventory. Small storage capacity with short contract periods and frequent changes of the source of supply is not a satisfactory arrangement as there may be times when it is quite difficult to secure prompt delivery of oil having the proper characteristics and delays may become serious enough to interfere with production.

A large storage supply—3 months to 6 months—has the disadavantage of large inventory. In some instances the investment carrying cost of storage equipment and investment in inventory may be more than offset by being able to purchase and fill the storage tanks when market conditions are extremely favorable. Frequently distress oil, that is, oil from a refinery that is overstocked and must have more room for other products, may be purchased at attractive prices under an agreement to take the entire lot or a specified portion at once. There are further arguments in favor of both large and small storage capacity depending upon local markets and shipping facilities.

A compromise that works out quite well is a system that will carry about 30 days' supply with the one storage tank empty and in process of being cleaned or repaired. It is convenient to have all of the tanks of the same diameter and capacity for uniformity aids in checking consumption, quantities unloaded and quantities transferred. Float indicators on the outside or above ground tanks aid in taking accurate daily inventories.

Storage tanks may be placed above or below ground. Local, state, and insurance regulations should be checked carefully before installing storage capacity. Tanks with retaining dikes above the ground cost less to install, are easier to clean, are accessible to maintain, and leaks in the tank or piping are readily discovered. Underground tanks may have oil leaks that may go unnoticed for a long time—or surface water may leak into a buried tank and contaminate the oil. Buried tanks if not properly anchored may when empty be buoyed up by ground water breaking pipe connections and doing other damage. Above the ground type of tanks may float if empty or partially filled providing water collects around them to a considerable depth unless the manholes are low on the shell and are removed for just such a contingency.

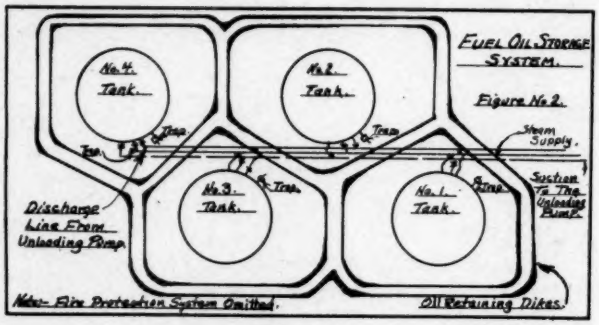


FIG. NO. 2

A typical storage layout is shown in Fig. No. 2. The storage as shown is for a storage system at some distance from the point of consumption. Between the storage and the burner in this case there is need of a service tank system for distribution of fuel to the various burner outlets. The unloading pump is used to pump from storage to service tank and in the transfer from one tank to the other. Pipe connections and pipe lines as shown is for a storage system that is quite flexible. It is desirable to have transfer connections in cases of fire, leaking tanks or so a tank may be emptied when the contents have reached a low level and quick emptying is desired to avoid trouble due to the tank floating in case of high water conditions around the tanks.

Storage tanks should be provided with heating coils around the pump suction so that viscous oil may be handled during periods of low temperature. A sketch of a satisfactory arrangement is shown in Fig. 3. The suction should be of the hinged type so that water and bottom sediment will not be pumped to the service tanks. It is well to keep the outlet at least 12 inches above the tank bottom. Each storage tank should be provided with a drain to draw water out at the bottom—condensation and water entrained with the oil should be disposed of at this point.

The fuel oil is pumped or gravitates as the case may be, to the service tanks which should be located as near to the point of consumption as regulations and safety permit. Fig. No. 4 shows a service tank and distribution installation designed for handling either light or viscous oils under any outside temperature conditions.

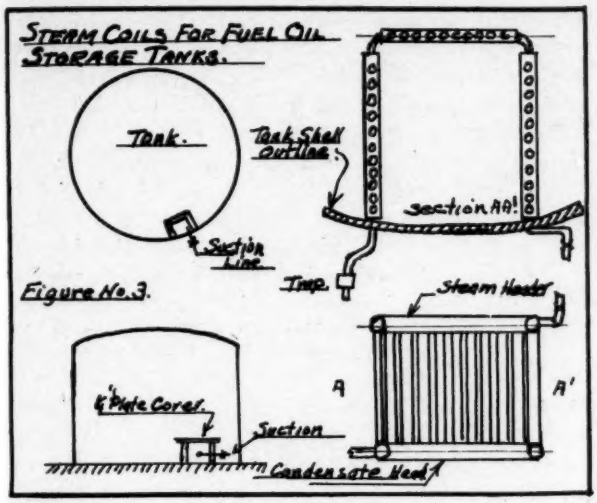


FIG. NO. 3

A distribution and service system must be as near fool proof as possible and equipment should be provided in duplicate so that a failure of one unit will not cause a shutdown. Service tanks are provided in duplicate so that one may be in operation while the other is being cleaned. The chief duty of service tanks is to provide a settling basin for solids and liquid impurities in the oil, to provide storage for a period of time preferably 48 hours or longer to allow settling of impurities and to act as overflow receptacles for a continuous recirculating hot oil system.

Service tanks located above ground are preferable to buried tanks, although buried tanks are safer from fire viewpoint, the disadvantages lie in cleaning, repairs and observation of leaks. In case service tanks are buried a check for leaks can be made by filling the tank and checking the oil level for several days with closed connections. If the oil level falls and all valves are tight there is evidence of a leak—the magnitude can be readily deduced by the gauge differences.

Water drains located at the bottom of service tanks enable an operator to keep water out of the tanks. Buried tanks as a rule are not sufficiently accessible for water drainage, from this point of view there is an advantage in above ground tanks. Steam coils should be provided in service tanks so that the oil temperature may be kept from 50° F. to 100° F. (depending upon viscosity characteristics of the oil) so that it flows readily. Manholes are desirable at the top and also at the bottom in the case of above ground tanks to facilitate cleaning. The fire hazard of service tanks is less when they are not housed.

The suction lines from the service tanks to the fuel oil distributing pumps should be made the full size of the pump inlet. Strainers in the suction lines are recommended to keep grit, scale and other foreign material from entering the pumps. A desirable valve arrangement for suction piping is shown in Fig. No. 4 along with pump house and distribution system piping.

If tanks are buried, positive type pumps should be used. Piston pumps of a multi-cylinder type give good satisfaction if proper air chambers are provided to smooth down pumps pulsations. In the case of service tanks above the ground at an elevation which permits oil to flow to the pumps or which gives very little lift (not over 3 or 4 feet) pumps of a centrifugal type having flat pressure-volume characteristics gives good satisfaction. Centrifugal pumps give excellent pressure control, the only argument against centrifugal pumps is that they are occasionally subject to priming difficulties especially, with hot oil when lifted a considerable distance. The pumps should be designed for hot oil and in specifying pumps this fact should be brought to the attention of the pump manufacturer. Motor driven pumps are preferred to steam driven pumps for the service system because they give better pressure control.

The first link in the distribution system from the pump is a pair of heaters set so that either will heat the full volume passing through the pumps; steam heaters of a closed type and steam trap are recommended. Heaters are needed to heat viscous oil entering the distribution system so that it will be hot in the lines and hot at the burners. Without heaters a fuel oil system is limited as to type of oil that can be handled with satisfaction and so are essential links in a system that is to handle either high or low viscosity fuel oils.

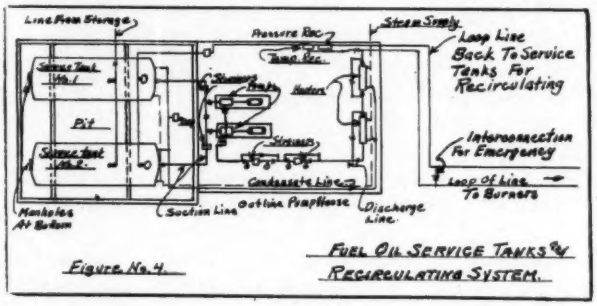


FIG. NO. 4

Duplicate strainers are necessary to strain the hot fuel oil to keep solids, scale, etc., out of the lines, basket type units with 100 mesh to the inch screen are preferable. If a pressure gauge is placed on each side of a strainer some idea of dirt accumulation therein may be ascertained. A good strainer will avoid many burner stoppages and is well worth the cost. Hot oil strains much better than cold oil and therefore the fine mesh strainer should be placed in the discharge line.

The oil may be kept at constant temperature by a thermostatic valve on the steam line feeding the heater, the thermostatic element being located in the oil discharge line from the heater. Pressure control is maintained by a regulating valve located on the return loop of the distribution piping. Temperature and pressure recorders are of value in controlling operation and the records obtained therefrom show just what happens to the fuel oil system every hour.

Distribution piping to be applicable for heavy or light oils must be provided with a return line to the service tanks.

From 30 to 50 per cent more oil should be pumped through the lines than is demanded by consumption so that hot oil courses through the entire system at all times. Standard pipe covering must be placed over all hot oil lines so that a maximum amount of heat will remain in the oil and short branch lines should be covered while long branch lines need in addition a throttled connection to the return line. Proper routing of the main service line will keep branch lines at a minimum length.

The recirculating system does away with dead ends and enables the line to be quickly flushed with clean oil in case water or sediment should by oversight be pumped into the line. With the old type line (single pipe system) contaminated fuel oil entering the line would give trouble for several hours, while with the loop system the effect is over almost as soon as a clean supply enters the pump. A hinged or double-elled suction pipe in the service tanks allows the accumulation of sediment to a considerable depth and adjustments of the suction level may be made as the sediment collects.

While the system outlined above may appear to be more elaborate than necessary to obtain operation the fact must be borne in mind that fuel oil troubles are a common cause of production loss in glass plants. In most cases fuel oil troubles are due to inadequacies of the fuel oil system rather than the fuel oil. The fuel oil system must also be sufficiently equipped so that it does not impose serious restrictions on the purchasing specifications, for a properly designed system will handle oil of low pour test and high viscosity specifications and the source of oil supply is thereby broadened, the net result being lower initial fuel oil cost. The difference in the investment of a system that will pipe fuel oil and a system that is a protection to production is soon repaid by increased production which is the result of freedom from fuel oil troubles. There is probably no part of a glass plant that needs more study and consideration and is more neglected than the fuel oil system and therein lies a field of endeavor for glass manufacturers to increase production and eliminate troubles and alibis common to the old type fuel oil systems.

The Manufacture of Rolled Plate

By ERNST LUTZ*

This work has been revised, so far as the English and the technical expressions are concerned, by F. W. Preston, who has also added a number of notes relating in general to the special conditions of American practice; but it must be understood that the opinions expressed in the text are those of Mr. Lutz, and neither the Editor nor Dr. Preston accepts responsibility for them.

The importance of heating from all sides the glass heap forming the pool between the tank outlet and the rolls, and at the same time maintaining its undisturbed flow to the rolls is stressed by U. S. patent 1654784 of Louis Boudin (Fig. 264). Not only the blocks c enclosing the outlet a but also the top and bottom blocks g and f as well as the check blocks h are heated and fit close to the rolls d and e. The check blocks h are laterally adjustable and can be drawn apart or together to regulate the stream of glass, or drawn entirely together to shut off the stream.

The German patent 450687 of Hugo Nowotny of Schwaz near Bilin (Fig. 265 and 266), too, exposes the glass heap in the funnel-like pool A before the rolls to heating from all sides. The funnel ends directly before the rolls and its outlet opening A" is (like the device shown by Figs. 254-256) horizontally elongated to almost the width of the sheet to be rolled. The feature of this invention protected by the patent is that the inlet opening A' of the pool A can be adjusted according to the level of the glass mass in the tank. This makes possible the positioning of the outlet opening of the pool A for that layer of molten glass in the tank that is most favorable for the rolling for the moment. As only small adjustments are necessary, the rolling machinery need

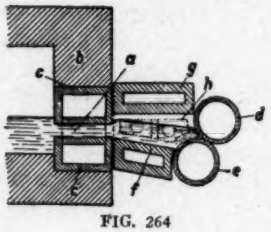


FIG. 264

not be rearranged too. Either the pool A only is changed in its position or the entire forehearth 2 together with the pool

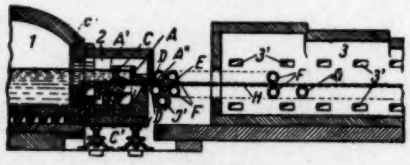


FIG. 265

A. In the latter case the joints of the parts of the furnace that move against each other are protected against the working in of glass by cooling devices C.

NEWER TYPES OF LEHRS FOR PLATE GLASS

Earlier in this chapter it has been explained what progress and advantages had been brought forth by the change from the single chamber annealing kiln to the lehr. The results were great savings of wages, fuel, and costs of maintainance; the lehr required less area than a plurality of single kilns together with the space needed for the transporting runway of the travelling casting tables. First of all,

* Of Dessau, Germany. This work is appearing in German in the new edition of *Dralle-Keppeler*, "Die Glasfabrikation."

FOOTNOTE: In the Figures, originally prepared for use eventually in the new edition in the German language of *Dralle-Keppeler*, "Die Glasfabrikation" in 1931, dimensions are given in metres (*m*) and millimetres (*mm*). We would like to have given these in feet and inches but the translation and the making of nearly two hundred and fifty new illustrations would have involved a prohibitive loss of time and expense. To some of our readers the metric system is as familiar as the English units; for the others we may say that a metre is approximately 40 inches, and a millimetre is approximately 1/25 of an inch. A thousand millimetres, of course, go to a metre.—F. W. P.

however, the annealing and the cooling of the glass were equalized all over the rough glass sheet and the tensions that had remained in the glass were diminished, all this effecting a better annealing and less losses through breakage. The yield of each casting and of each melting pot became greater. The warping of the rough glass sheets in the lehr was much less than in the single kilns and the sheets were much flatter after the annealing process. The adoption of the lehr permitted also the use of the stationary, water-cooled casting table instead of the travelling table. The stationary table yields, by the mere rolling process, sheets of more uniform thickness and better evenness of the surface and thus makes it possible to roll the sheets thinner which means further increase of yield per pot.

The zigzag arrangement of the pre-annealing chambers, however, was still a cumbersome addition. In spite of wide-

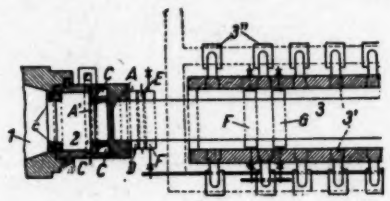


FIG. 266

spread distribution of the burners to heat these pre-annealing-chambers, uniform temperatures could not be obtained throughout all of a chamber and steady graduation of temperature from chamber to chamber at all points. The zigzag form gave rise to dead angles and to clogging and whirls in the stream of the heating gas which disturbed the perfect uniformity of the annealing and of the subsequent cooling down all over the rough glass sheet leaving tensions in the glass that sometimes produced breaking of the sheets through trifling occasions during the further treatment of the glass. These irregularities of the heating were unfavorable to the zigzag-shaped floors of the chambers either. Great care and great skill to be won by experience were required for the control of the burners to avoid the floor warping and the rough glass sheets becoming crooked. It is more difficult to keep control over a zigzag-shaped floor and to re-shape it after eventual deformation than would be the case with a straight floor.

Even if by experience these drawbacks had become endurable as compared with the conditions inherent in single annealing kilns, yet they increased the desire to avoid the zigzag form, especially as it involved poor utilization of space and many difficulties arose if it had to be adapted and added to already existing lay-outs. If combined with modern rolling machinery—and especially with the Bicheroux—machine where one melting pot produces several rough glass sheets which must be conveyed to the annealing oven in the quickest way—it was very difficult and in any case a complicated matter to meet all requirements by means of the zigzag lehr.

Considering the dimensions of the sheets it was impossible to build the lehr straight throughout (as is done in the wire and ornamental glass industry, for instance) as long as one could not construct shifting devices that were sufficiently heat resisting or sufficiently protected from the heat as to be able to follow the entire straight part of the lehr ahead of the point where the glass has grown stiff enough to be transferred to the conveying mechanism of the runway proper.

As previously stated, the Herzogenrath Glass Works have attained this aim by a lehr which is partly illustrated in Figs. 236 C-236 D'. A lehr of this design is able to convey rough glass sheets of the greatest widths that can be met with in present practice over the length of the straight pre-annealing-chamber corresponding with those widths. In connection herewith attention may be called again to Fig. 236 E which shows the lay-out of a rough glass shop with 2 lehrs of said type. Depending on the width of the rough glass sheets the straight pre-annealing-chambers are 65 to 85 ft. long. As their working range is so long, the shifting tools cannot be taken out of the lehr for cooling purposes but must at all times stay exposed to the heat—almost 1,300° Fahrenheit in the hottest zones and even more if streams of heating gas hit them. Therefore the point is to make the actual shifting tools of heat resisting steel and to construct the supporting mechanism so that they can be cooled on their insides yet do not have an unfavorable chilling effect upon adjacent glass. Moreover, those parts which which impart the to-and-fro motion as well as the up-and-down motion to the shovels are partly withdrawn from the greatest heat by being positioned in two lateral channels deeper than the bottom of the lehr and are in part entirely withdrawn from the heat by being placed outside of the oven (German patent specification 504,555).

These arrangements may be seen from Figs. 236 C-236 D' and are further explained by Figs. 267-271. Two trucks i,i carry the rough glass sheets from the rolling machine to the lehr, and the travelling crane 1 shoves them from the trucks into the oven. As has been stated before, at the rolling machine the rough glass sheets are not nowadays any longer divided lengthwise but only transversely. Therefore, nowadays the two trucks i,i are combined in one single, large truck while the crane 1 needs but one shoving tool instead of two.

Inside of the lehr are the cross-girders f to which are adjusted the stowing tools c. At their sides the cross girders f are tightly fixed to the two longitudinal girders g. All of the girders f and g thus form one rigid frame. This frame can be moved horizontally to and fro on the rails o by means of the trolleys h and the pulling mechanism s. The rails o again on their seats q are tightly fixed to the cross beams p which can be moved vertically up and down by the mechanism k, r. Thus the whole system c, f, g, h, o, p, can be raised and lowered.

In Fig. 267 crane 1 is just pushing two new rough glass sheets d into the lehr. The frame f, g is in its extreme left position, and the above described system with the shovels c is raised to its highest position, so that the new rough glass sheets can be inserted into the lehr without difficulty beneath the shovels c (Fig. 268). In Fig. 269 the frame f, g is pulled to the right to its furthest working position and the whole system is lowered till the stowing tools c, which are adjusted to the cross girders f with a light tension, touch

the bottom of the oven in order to be able to carry the sheets along when the position of the frame f, g is again changed to the left. b represents the mechanism of the lehr which automatically conveys the sheets in the well-known manner (Fig. 270).

The girders f and g are hollow and on their outsides protected from heat by insulation. Their insides are cooled by air so that their walls do not reach temperatures of more than 600° Fahrenheit. The heat resisting lagging at the same time prevents the rough glass sheets from being chilled in the neighborhood of the girders.

In the figures, w designates an electric lifting magnet which is positioned in the shifting crane l and through

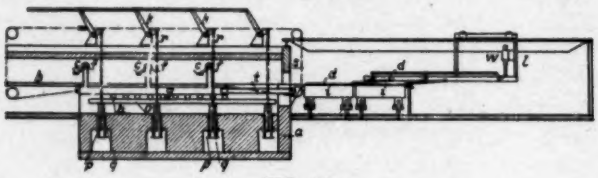


FIG. 267

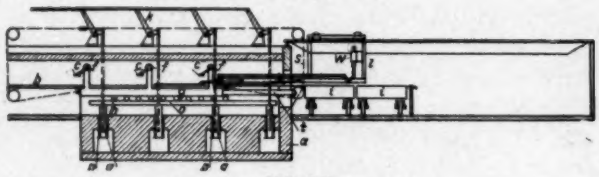


FIG. 268

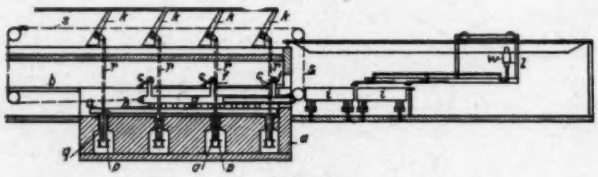


FIG. 269

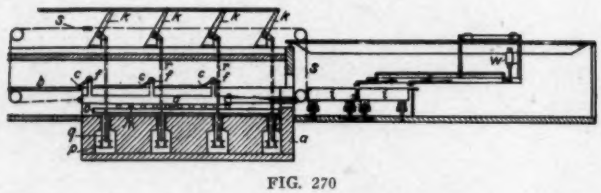


FIG. 270

which by means of ball-crank levers the pushing edges of the stowing tools are raised and lowered. If the core of the magnet is pulled on, the pushing edges are lowered to their operating position. By means of a short cut-out of the circuit the core of the magnet falls back and raises the pushing edges on account of its excess weight, so that the stowing tools while returning out of the lehr do not touch the bottom of the oven and do not wear it away. They are balanced in such a manner that on their way into the lehr they grip the sheets securely, but exert so little pressure on the bottom of the lehr that its wear is reduced to a minimum.

Other types of lehrs were developed in connection with those rolling methods by which a continuous glass ribbon is produced from a tank, i.e., by the flowing-out method. They were based on those annealing ovens that up to that time had proved good for the production of drawn glass. See e.g., Dralle-Keppeler, Die Glasfabrikation, Fig. 690 on page 748, chapter 9 of Vol. I. The endless belts or chain tables employed as drawing machines were in principle adopted as devices for the conveying and flattening of the glass ribbon. As with the drawing machine, the glass, after it has become sufficiently stiff on the endless belt or chain table, is then received by conveying rolls which carry it through the whole lehr.

For endless belts to support the still soft glass, smooth or twisted steel belts are employed which again are supported by rollers or plane supports and cooled on their way back. In Fig. 257 for instance, 13 indicates such a steel belt sliding over the plane and water cooled table 14 and cooled again at 17. The disadvantage is, of course, that the glass sticks to the

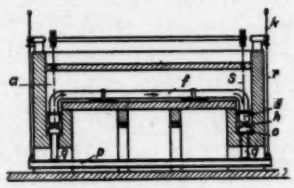


FIG. 271

steel and that the steel soon burns if not rapidly cooled. The sticking can be counteracted a little by having the steel belt running slightly faster than the glass ribbon. The glass is chilled too quickly and has no time for proper annealing. Besides, smooth steel belts distort. Therefore, ribbons or belts of strong asbestos tissue are preferred. In order to protect the glass from chilling, above the glass is also fixed an

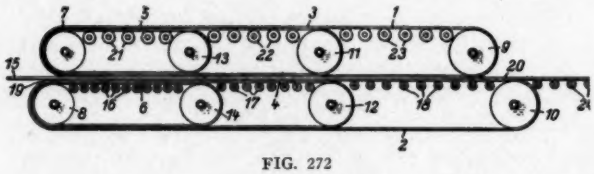


FIG. 272

endless belt of asbestos the lower part of which is a little slack so that it rests on the surface of the glass as a guard. According to U. S. patent 1,595,103 of Charles B. Kingsley, assignor to the Mississippi Glass Company of New York, the belts of asbestos vary in thickness from one end to the other (Fig. 272). For instance between rolls 8 and 14 and 7 and 13 respectively, are mounted three layers of belts; between rolls 14 and 12 and 13 and 11 respectively, two layers and toward the end only one layer. By this arrangement a slow and gradual cooling effect should be obtained. According to this patent specification the upper belt of asbestos 1 should be wider than the lower one and in addition should be a little slack so as to fall around the edges of the sheet and protect them from too rapid cooling. Rollers 16, 17, 18 underneath the belts support the glass sheet. 24 designates the rolls which convey the sufficiently hard sheet through the rest of the lehr.

As far as sheets of greater width are concerned, tables are preferred for the first support which (similar to the rolling tables initially used by the Ford system, Figs. 237-239) are formed by endless chains with plane segments attached to them. These segments consist either of pressed asbestos or in most cases of steel plates the supporting surface of which is ground. These plate belts can be produced with such

accuracy that sufficiently plane sheets may be cut out of the glass ribbon. The plate belts usually have to be cooled when returning, which impairs the good annealing of the glass in the first section of the lehr. This must be considered at the outset when the batch composition is decided on. A batch containing much limestone and little alkali would in this case yield badly cooled and brittle sheets of glass. Some presume that a constant layer of insulating air forms itself between the soft glass and the ground steel plates preventing the glass from too rapid cooling.

From the chain table the glass travels over a line of rollers through the adjoining runway. These rollers consist either of pressed asbestos or air-cooled tubing. In the latter case they are often wrapped in some heat-protecting material in the first section of the cooling channel in order not to chill the glass and cause cracks. At the starting end of the runway the rollers are placed at small distances from each other. Toward the finishing end the rollers can be set more apart from each other. The rollers are mostly driven by worm gears and clutched to each other. They are so mounted that they can easily be interchanged, the bearings of both ends being located outside of the oven. This type of roller conveyor has been generally adopted for the transportation of glass ribbons and has proved good.

For rough glass sheets from pots also the roller-lehr has been adopted. It has been found possible constructing and cooling rollers of great length and relatively small diameter so that they do not perceptibly bend or distort. They are able to convey sheets of the greatest dimensions found in practice without damaging or deforming them. Since the

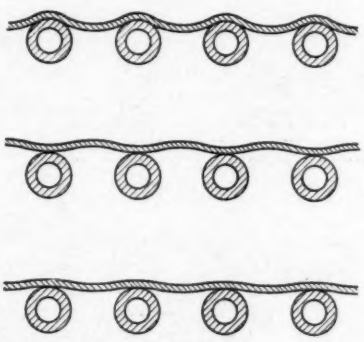


FIG. 273

sheets sag between the rollers as long as they are still soft, it was necessary in the beginning to push them over a plane bottom or to send them, as is done during the cooling of a continuous glass ribbon, over a link-belt table before they were received by the rollers. Soon, however, one found out that one only needed to have the hot glass sheets travel fast enough over the rollers to get them to solidify. For several reasons to be explained later, this conveying velocity cannot exceed certain limits. Therefore, the glass has in practice still enough time to sag between each pair of rollers. But these hollows of the glass rise at once to the next roller, the hollows thus becoming the hills and the hills now and then becoming subject to sagging. As the glass gradually solidifies these hollows become less and less and approach more and more the plane form. This process is illustrated by Fig. 273 the rollers in this illustration being placed at an exaggerated distance from each other. With a travelling velocity of the sheets of 25-35 ft. per minute (agreeing with the rolling velocity) sheets of very good evenness were obtained. In the meantime, however, as has been stated before, the rolling velocity has been raised to 100 ft. per minute and even more. If the sheets coming from the rolling machine travel with so great a velocity over the adjoining roller way, an evenness is obtained that can scarcely be obtained by any other method.

This led to sending the sheets of rough glass as they come from the rolling machine directly over a roller way which conveyed them without any further hand or mechanical treatment into and through the lehr (Fig. 236 A).

The high travelling velocity of the freshly rolled sheets on the rollers is necessary only till the glass becomes sufficiently hard and does not sag between the rollers any more. If they were conveyed further with the same velocity, the oven would have to be of a practically impossible length in order to secure the necessary duration of cooling. The customary "cooling velocity" lies, depending on the thickness of the sheets, between 7 and 14 ft. per minute. After the sheets have grown stiff, they must be shifted from the high rolling velocity to the slow cooling velocity with which they travel through the greater part of the lehr. A great many proposals were made to accomplish this end which differ mainly in that the sheets either proceed by intervals or travel continuously and with equal velocity through the main part of the lehr. In the first case, all sheets in the lehr remain stationary until a freshly rolled sheet has approached the last one to within a foot or two. Then all sheets inclusive of the newest one advance simultaneously for the length of one sheet. However, the sheets are not arranged with their lengths as in the crosswise of the lehr, but parallel to it. Therefore this method is detrimental in as far as the glass is subjected with every advance to a sudden and rather great difference of temperature. If at that point where the rolled sheets halt for the first time there prevails a temperature of about 930° F. and if the lehr is about 750 ft. long, there is an average gradation of temperature per foot of more than 1° F. If, e.g., the sheet is 30 ft. long the clearance between the sheets being 1—1½ ft., the glass has to undergo a rather quick drop of temperature of approximately 34° F. Sheets of rough glass that have not been properly annealed in the starting end of the lehr are thus easily caused to break, especially as their head and tail ends lie in differently heated zones and since the gradation of temperature is not in practice uniform throughout the whole length of the oven, so that, in some zones the difference of temperature is even greater than on the average above said.

In the second case where the sheets proceed continuously with equal cooling velocity, the rolling velocity of the last arriving sheet must be reduced to the cooling velocity as soon as it has come close to the preceding sheet. A set of conveying rollers, therefore, must be adapted to be driven either in correspondence with the rolling velocity or with the cooling velocity. If the sheets were simply shifted from the high speed rollers directly to the slow speed rollers they would get there just the same; however, while being shifted

the sheets would be stopped in the front by the slow speed rollers and at the same time pushed forward from behind by the high speed rollers; this would cause the sheets to buckle. If a sheet were already so hard that it could not buckle it would break on account of the shocks. Aside from that there is the danger that the sheet would be pushed against the preceding one or, on the other hand, would stay too far from it thus causing bad utilization of the lehr.

Figs. 274-276 show an older type of a roller lehr according to U. S. patent 1,683,973 of Herman S. Heichert, assignor to the Pittsburgh Plate Glass Company of Pittsburgh, Pa. Fig. 275 is the continuation of Fig. 274. After being rolled out by the rolling machine the sheet of rough glass advances over the set of rollers 18 directly into the roller runway of the lehr. The latter is divided into a plurality of sets 19 to 28. Set 28 is very long as it extends to the finishing end of the lehr. The rollers of each set are driven jointly which means that they all have the same rate of peripheral speed be it a high or a low rate. But each set can be driven independently from the other sets at a high or low speed. For instance sets 18 to 23 can be driven in correspondence with the rolling velocity. When the forward end of the sheet reaches the point C, the speed of the sets 19 to 23 can be reduced to the slower speed of set 24, from point D to the still slower speed of set 25, etc., etc., till from point G onward the final speed of set 28 has been reached. On the other hand, when the sheet of rough glass reaches point C, the following sets can be speeded up till the sheet reaches point F from where the speed may be reduced to the cooling velocity of set 28. By contacting of the sheets with the switch arms 32, 33, etc., the shifting of the respective speeds may be performed automatically.

This manner of operation was possible as long as the rolling velocity did not exceed 25 to 35 ft. per minute. With the increase of the rolling velocity, however, the length of the forehearth which reaches to set 27 inclusively would have to be increased also. Measured on the rolling velocities to be found nowadays this forehearth would require lengths that are out of question. A profitable combination of a high speed rolling machine and a roller lehr was only possible when there was found a means of conveying the still soft sheets continuously and quickly enough over the rolls and yet keeping the forehearth of suitable dimensions.

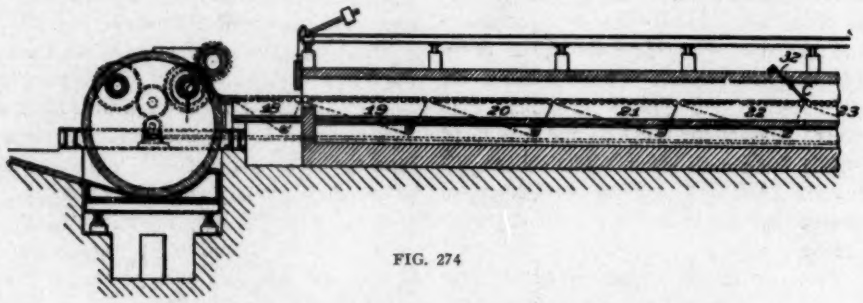


FIG. 274

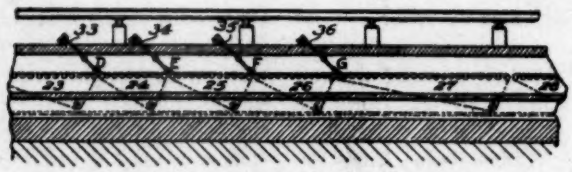


FIG. 275

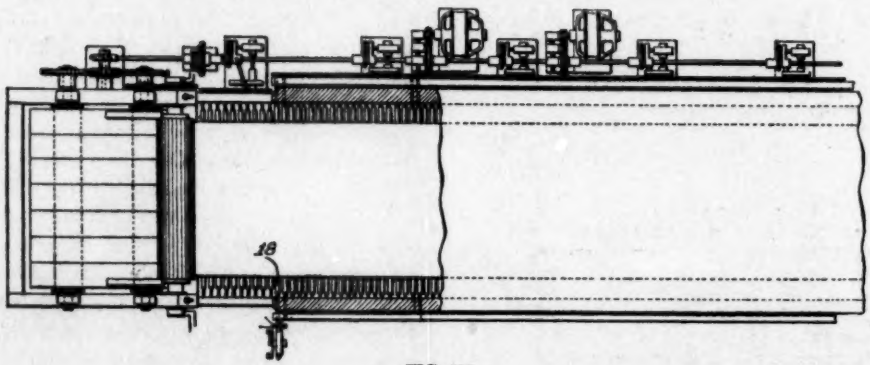


FIG. 276

This end was attained by conferring an oscillating to and fro motion upon the freshly rolled sheet of rough glass after it has reached the head of the lehr; see, e.g., German patent specification 511,244 of the N.V.My. tot Beheer en Exploitatie van Octrooien in Haag, Holland. The length of an oscillation to or fro can use up from about 4½ to 7 ft. To have the sheet properly annealed and later on steadily

cooled, the oscillating motion must be performed at several points, i.e., the sheet must from time to time be moved into a zone of moderate temperature and there be oscillated further till it is hard enough to be brought on the cooling velocity. Every 6th to 8th minute there must be cleared space for a new sheet to be inserted.

The gradual advancing and, consequently, the steady cooling of the oscillated sheet are considered in an especially advantageous manner by the patented method of the American Simplex Engineering Company. The sheets are moved to and fro in the manner of the pilgrim's step, i.e., each movement towards the finishing end of the lehr is a little greater than towards the rolling machine. If for instance a movement towards the finishing end of the lehr amounts to 5½ ft. and to only 5 ft. toward the rolling machine, the sheet advances with every to and fro movement for ½ ft. towards the finishing end of the lehr. Figs. 277 to 281 represent a lehr operated in this manner; the figures are taken from the French patent specification 674,873.

The lehr is heated by electricity. In two of the figures may be seen the heating devices 23 positioned above and 24

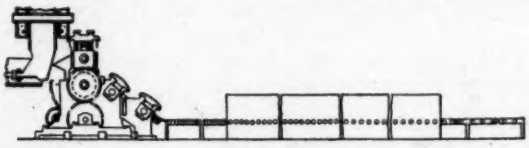


FIG. 277

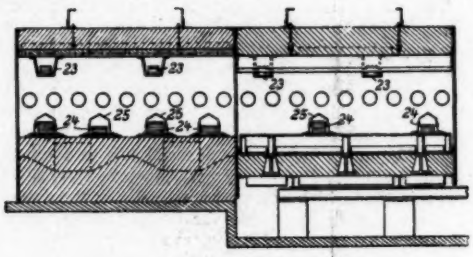


FIG. 278

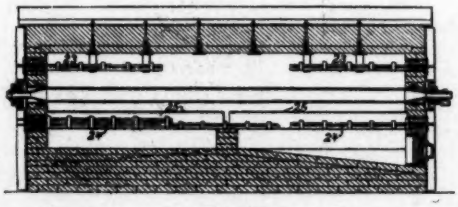


FIG. 279

positioned below the roller way; the lower ones are protected from falling fragments of glass by means of the roof-shaped casings 25. According to the report by Herr von Reis reproduced in an earlier chapter such a lehr combined with a Bicheroux-rolling machine of the National Plate Glass Co. of Ottawa consumes approximately 700 kilowatt, the lehr being about 740 ft. long and the sheets of rough glass being 12 ft. wide and 11/32" thick.

The length of the roller way on which the movement in the manner of the pilgrim's step is performed must, for the purpose of receiving the sheet, have at first a uniform speed corresponding with the rolling velocity and, later on, another uniform speed corresponding with the cooling velocity for the purpose of delivering the sheet into the real cooling channel. The pilgrim's step motion and the synchronizing of the pil-

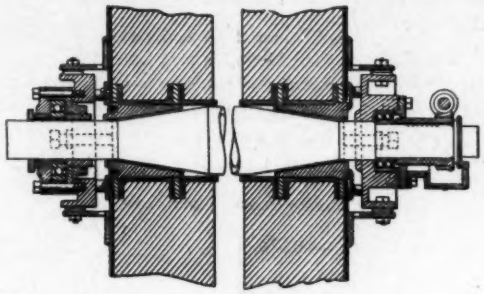


FIG. 280

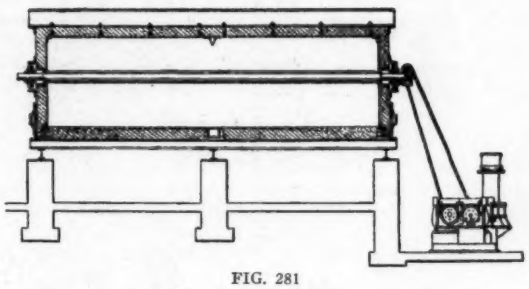


FIG. 281

grim's step-rollers with the preceding rollers which are driven in correspondence with the rolling velocity, and afterwards with the adjacent rollers which are driven in correspondence with the cooling velocity is done automatically by electricity. The arrangements and switching devices necessary thereto may be seen from the patent specification mentioned above.

Fig. 278 represents a short part of the longitudinal section of the oven; at the left hand is illustrated a more strongly heated, at the right hand a less heated zone. Fig. 279 illustrates a transverse section of the hot part, Fig. 281 of the colder part of the oven.

The lehrs operated by this system are said to produce perfectly cooled rough glass sheets of very best evenness.

CONCLUSION

In the beginning to this chapter it has been said that in spite of the rigidly controlled conventions of manufacturers in most countries the technique of producing rolled plate has not stayed still. When that sentence was written, quite some years ago, it referred primarily to the progress which had up to then been achieved in exercising the old methods of rolling the glass poured out of pots on a large table and of grinding and polishing on circular tables. The "new" methods were still in a stage of infancy and the opinions about the prospects of the different ways in practice diverged very much. In the meantime these new methods have made their way and almost completely supplanted the old method; the time when the latter will finally have died out is not very distant.

The knowledge and experience gained in exercising the old method made up the fundamentals from which to start the experiments and the success of all new methods including the

(*Continued on page* 169)

Glass Industry

ESTABLISHED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials and Glass Factory Equipment and Operation

PUBLISHED MONTHLY

Copyright, 1932 by

GLASS INDUSTRY PUBLISHING COMPANY, INC.

2 Duane Street, New York

Telephone BEekman 3—0474 Cable Address Glasdustry

G. W. Cooper, Managing Editor

Subscription Price..United States $2.00 a Year; Foreign $3.00
Single Copy .....25 Cents

Vol. 13 OCTOBER, 1932 No. 10

CONTENTS

	Page
Glass Plant Fuel Oil Systems	159
The Manufacture of Rolled Plate	162
We Sought and Found Business Just Around the Corner	168
Mike Owens as a Human Being	170
Rotax Electric Controller	172
Preliminary Census Report on Glass for 1931	172
Important News of Glass Division Fall Meeting	173
Corning Glass Drills for Gas	173
August Production of Polished Plate Glass	173
Inquiries Received	173
Current Prices of Glass-Making Materials	174
Monthly Summary of United States Foreign Commerce in Glass	174

CLASSIFIED BUYERS' GUIDE, PAGE 8

INDEX TO ADVERTISEMENTS, PAGE 9

Removal Notice

The office of THE GLASS INDUSTRY has been moved to the Rhinelander Building, 2 Duane Street, New York.

Reference to the contents of earlier issues of THE GLASS INDUSTRY can be found in THE INDUSTRIAL ARTS INDEX in many Public and Technical Libraries.

We Sought and Found Business Just Around the Corner[1]

By THEODORE SWANN, *President, The Swann Corporation, Birmingham, Alabama*

To determine "where business was hiding," The Swann Corporation instituted a plant-by-plant survey of the chemical needs and buying habits of Industry. Mr. Swann writes: "We went into this undertaking because it seemed to us the best defense against economic pressure." To date, the investigators have completed 6,000 calls in 23 States with these results: The survey paid for itself in new business . . . It has given us new specific objectives for research developments.

WE decided not to wait for the arrival of prosperity, but to go out and determine for ourselves where business was hiding. Ohio was selected as the sampling ground for a widespread plant-by-plant survey of the chemical needs and buying habits of industry. Ohio is big industrially; its manufactures are diversified. Yet we thought that we knew where most of the customers and potential customers were. Long before our investigators completed their work, we found that we did not know. We had unearthed millions of dollars of potential business that we never knew existed.

Some of this business was already in good hands—our competitors'. A greater share was getting no one's serious attention. A third and not inconsiderable share was new business in the strictest sense—business based on the *need* for new chemicals or the application of chemicals already available. That was our experience in Ohio.

We completed our study in this State, and then moved on. So far, our investigators have made more than 6,000 calls in 23 States. The work is still going on, but it has advanced far enough to convince us that the Ohio experience is typical.

The basic survey procedure was simple. State by state we built lists of industries, from the largest corporations to the smallest wayside service stations. Care was taken to make these lists as complete as possible from accredited sources, then to augment them from such sources as Chamber of Commerce lists and 'phone directories. Ten days before the investigator was scheduled to make a call, a general letter over my signature reached the head of the organization which was to be visited. Seven days later, a second letter was sent announcing the investigator's call.

All this work was organized in the central office under the supervision of experienced industrial marketing men. Here plans, based on our preliminary experience in Ohio, were laid; forms were prepared; route maps were worked up; and lists of industries for every place to be visited were compiled.

The men who were to take part in the survey were brought together and the scope of the work and the character of their activities was explained to them. Then, armed with material and detailed instructions, they were sent into the field.

In general, each new group of workers carried on for a week under the immediate direction of an experienced man who traveled with it. Then they were brought back to the central office to discuss their experiences and prepare their initial reports. Through this method, it was thought that the men could teach each other by comparing notes, by criticising each other's methods, and by relating their own special experiences. This proved to be the case.

The first step that each man took when entering a new community was to check his list of industries in that community, as received from headquarters, with local sources of information, to make sure he was covering every prospect. A list showing every possible user of chemicals was supplied for this purpose.

Analyzing Field Reports

Data secured were entered in duplicate on specially prepared forms, and both copies were sent in daily to the district office of the territory in which he was working. On receipt of these forms at the district office, one copy was sent to headquarters where it was analyzed with reference to the company's general business, suggestions for new developments, etc., and the other copy was

[1]Executive Service Bulletin, Metropolitan Life Insurance Co.

retained at the district office to serve as a guide for future selling activities.

It is probably true that no industrial survey of any scope can be better than the investigators' ability to secure information from the company official and to meet unanticipated situations. We were particularly fortunate in the type of men available for the work. They were executives, scientists, production engineers, and salesmen not usefully engaged in their special fields by reason of depression.

When these men made their calls, they recorded specific data in accordance with form requirements—purchases in dollar volume with respect to source, grade, container requirements, f. o. b. point, etc. In addition, they reported under "Special Information":

1. Buying influences (*whether quality, price, service, friendship, reciprocity, stock ownership*); and
2. Possible new uses of chemicals and need for new developments.

In this category, there was reported an almost limitless range of needs for new chemicals and new applications. We learned that the service station wants a better compound for cleaning automobile parts. We developed that compound. In the laundry industry, a dozen chemicals are known to be in general use. Our survey reported thirty-four materials, thus opening up new opportunities for technical research. So, with forty-nine different industries, we found room for improvement and new markets for chemicals today and in the future.

Each investigator was instructed to limit his visit to fact-finding, to make no sales solicitations. Following his visit, the prospect received a "thank you letter," which invited further co-operation with the Swann organization.

In the main office, each report was coded and then placed in an automatic classification machine, an elaborate piece of equipment, which, so far, always has given us the most detailed and comprehensive information needed on our markets.

Of course, the chief benefit of this survey lies in the picture it has given us of the chemical market—a picture made up of these component parts:

1. Definite data on all prospects in each sales territory. *An evaluation of real prospects, potential prospects and actual "duds."*
2. A comprehension of chemical needs by industry. *A sales "assist" and a guide to further research.*
3. An analysis of the competitive situation. *A comparative study to determine what competitors are* not *doing to develop optimum sales.*
4. A determination of the location of business as a step toward cheap and efficient distribution.
5. An interpretation of the needs for new products and new uses for existing products.

We went into this undertaking because it seemed to us the best defense against economic pressure. The alternative defense—discharging surplus forces and "digging in" all along the line—did not appeal to us. Not only did it mean intensifying the depression, but there was little to commend it in the experience of those who had adopted the policy.

The immediate results of the accumulated survey data—sales prospects—have more than justified the expense. To follow up these specific leads, we are opening five new district sales offices and establishing resident salesmen in ten other cities, increasing our sales personnel by more than 50 per cent. Because we were able to trace with accuracy the flow of various chemicals from sources to users, it was possible to determine strategic "focal points" throughout the country.

I want to emphasize that, if we had staged a mere raiding expedition and were securing our increased business solely at the expense of other manufacturers, we would not be justified economicaly or commercially. We would have contributed nothing to the country's welfare; we would, sooner or later, be raided ourselves. From the very beginning, we realized that the survey genuinely would improve our position only if it led to the development of new products, applications and methods that would benefit the industries we served.

I agree with Prof. Adelbert Ames, Jr., of Dartmouth College, that prosperity cannot return or be maintained without a steady flow of time-and-effort-saving new developments. I also agree that many industries, in their efforts to fight depression, have killed the goose that laid the golden eggs. They have curtailed research work (and, it may be added, the promotional work that brings the results of research to the attention of the public.)

Responsibility of the Industry

From another point of view, I believe it incumbent on the chemical industry to do what it can at this time to stimulate commercial activity. The last fifty years have witnessed an astonishing array of electrical and mechanical developments—the telephone, electric light, electric motor, automobile, radio, and the airplane. Each of these has helped to raise our standard of living; each was a factor in prosperity. While they still play their parts in our daily lives, they have ceased to be active agents in building up constantly increasing business (except the airplane, which still has latent possibilities).

In the chemical industry, on the other hand, there are many possibilities. Research was stimulated greatly by the war; the number of laboratories rose from a few hundred to nearly two thousand in the decade 1920-1930. While many are not strictly within the chemical industry, most of the actual laboratory work done is of a chemical nature. The number of new chemical compounds and processes has multiplied enormously, many of them as valuable economically as rayon and cellophane. They need only comparable merchandising effort to become as important commercially.

To sum up my estimate of our survey undertaken in terms of this potential chemical development:

1. The survey paid for itself in new business.
2. It has given us new specific objectives for research development . . . probably more important in years to come than the more tangible evidence of immediate sales opportunities.

The Manufacture of Rolled Plate

(*Concluded from page* 167)

operation of rolling machines fed from tank furnaces and of the straight and continuously working grinding and polishing lines. This well justified the inclusion of the description in its entirety of the old method, written quite some years ago, in the present edition of Dralle-Keppeler, Die Glasfabrikation. This description is best suited for showing the course of development. The general and fundamental explanations that had to be given for the old method would have to be said for the new methods, anyway. The difficulties and special requirements inherent in the manufacture of plate glass and distinguishing it in the whole glass industry, had naturally been already so clearly pointed out while describing the old method that a picture was drawn beforehand of all the tasks and problems that had to be solved to develop the new methods for large scale production.

It would not be the time yet to predict the significance of the one or other new method for the future. By far the greatest field in America as well as in Europe was found by the Bicheroux system, not only because it is most adapted to the old method but also because up to now it meets best all requirements of the market concerning quality, thickness, and dimensions. One may, however, anticipate that construction and operation of the tank furnace will be further developed to such an extent that by the working with the tank all needs will be satisfied. The ladling method with the mechanical scoop has already come very near this end. The defenders of this latter method already deny that there can be any doubt as to the capability to produce in continuous operation plate glass out of the tank of as high a quality as out of pots. If their hopes come true one may indeed suppose that even the ladling method is but a mere intermediate step and that the further development will come from the continuously working methods—tank with drawing or rolling machinery and adjoining straight grinding and polishing line; however, the difficulties to overcome are still considerable.

Mike Owens as a Human Being

His Vivid Career Interestingly Summed Up in a Series of Letters

By JAMES MORRISON

Just about two years ago at the Glass Division meeting at Cove Point the opinion was expressed that the memoirs of our principal inventors are in a deplorable state of insufficiency, and it was resolved to try to acquire and publish something more than perfunctory obituaries. Definite attempts to do so were made, and through Mr. Roy Blunt we were able to obtain the memoirs of Mike Owens that follow, from the pen of Mr. James Morrison, without whose indispensable cooperation these stories would never have seen the light of day. We believe that these show Mr. Owens as a human being better than most of the scattered notes that have yet appeared, and hope that they may assist in some small measure to keep alive the memory of a man rather than of a name. —*F. W. P.*

Letters Written by Mr. Morrison to a Friend

Dear Henry:

The measure of pleasure is memory. That which you can look back upon after a lapse of years and smile at the recollections brought up, must have had at the time of the occurrence something that left an impression and the impression must have been a pleasant one.

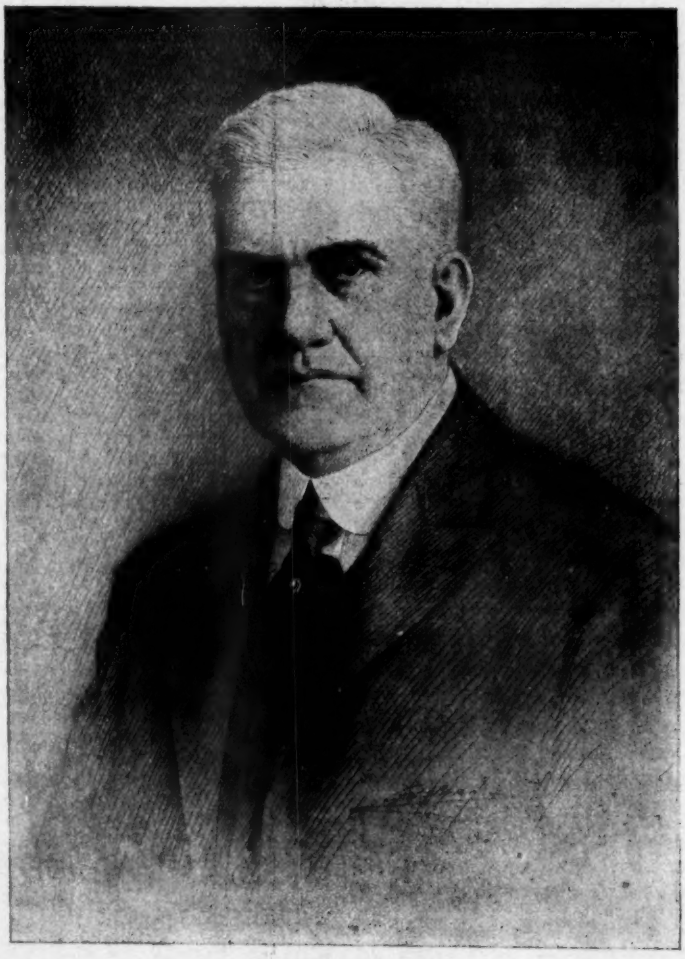
My talk with you this morning inclines me to be reminiscent, and at the moment I am thinking of my first meeting with Mr. Owens and my first sight of the Owens machine.

In 1888 the American Flint Glass Blowers' Union had its convention at Canton, Ohio. At that time practically all the glass workers of the country except window glass workers, belonged to that organization. In its day it was quite powerful. To be elected a delegate to one of its conventions stamped one as being outstanding in his working group.

At the convention referred to above Mr. Owens was a delegate from Wheeling, and I from Pittsburgh, Pa.

There was a notable fight in the convention. The summer stop rule was one that the Glass Workers' Union insisted on no matter what the conditions might be. In those days it was almost a religion with them; particularly was this true of the Ohio Valley group in which Mike was an outstanding personality.

In Brooklyn, New York, there was another quite powerful group of workers similar to those in the Ohio Valley. Some of this Brooklyn group had started a cooperative factory and for various reasons insisted on operating throughout the July and August shut-down period in 1888. Brooklyn had a noted character named James Smith, who always came to the convention wearing a plug hat, Prince Albert coat and carried a gold headed cane. While he was quite illiterate, he was a powerful debater, as debaters went in a group of that kind. Mike crossed swords with him in the convention in a demand that they shut down their plant immediately during the July and August period under penalty of expulsion from the union. Mike was pugnacious as well as forensic; Smith from Brooklyn, was likewise pugnacious and forensic. Mike won, probably not so much because of the logic of his contentions, as because of the vehemence with which he presented his case. As I recall the picture now, it reminds me of a modern wrestling match where every hold is legitimate if the referee does not see what is being done.



MICHAEL J. OWENS
IN HIS PRIME

That was my first contact with the man who later became world famous in the bottle business, and if I had never met him afterward and if his light had not shown so brightly as it later did, I would still remember him because of the notable battle between him and his forces from the Ohio Valley and the Brooklyn forces backing up their champion, Jim Smith.

One of the entertainments provided during the convention at Canton, Ohio, was an outdoor banquet on the shore of Myers Lake. Food was in abundance and the ever present kegs of beer were set up at many and convenient points. I happened to sit somewhat close to Mr. Owens, with whom I had by this time gotten well acquainted. We all hung our hats, and most of us our coats, on a picket fence that was nearby. I happen to wear a somewhat large hat, very much larger than the average person. After the banquet was over and we had mulled around for quite a while, visiting with each other and with the kegs that were sitting around, I went to seek my hat and the only one I could find was quite evidently not mine, as it sat very high on the top of my head. For quite a while I searched around feeling quite sure that whoever had my hat would find it coming well over

their ears. It was quite a while before I saw a group apparently enjoying something, and I went over to see what the interest was and saw Mike displaying a hat on his head many times too large for him. I immediately made an exchange with him that was quite satisfactory because he had gotten hold of my hat while I had his.

Some time later, in fact in 1900, I went to Tarentum, Pa., as general manager of the Fidelity Glass Company, previously having managed another factory. In the meantime I had followed the career of Mike, knew of his coming to Toledo and the circumstances that brought him here. Also, I had learned of his progress in the developing of a bottle making machine.

The Fidelity Glass Company was then probably the largest maker of milk bottles in the country, which happened to be a business very much smaller than it is today. We were making these all by hand, and it occurred to me that my acquaintance with Mr. Owens might be used in connection with this machine to the advantage of the Fidelity Glass Company. We had a secretary, a Mr. Ritchie, who was connected with the Pennsylvania Salt Manufacturing Company, and he and I were authorized to come to Toledo and see the machine. Mr. Libbey brought Mr. Ritchie and myself to the factory, where one little machine was set up making amber beer bottles. We spent several hours watching its operation, and I, being the glass worker, was naturally very interested in it, but somehow I could not interest Mr. Ritchie, who very much disgusted me in the midst of the investigation by inquiring if a boat could be taken from Toledo to Cleveland, as he wanted to enjoy the novelty of a ride on the lake. His inability to grasp the significance of what was presented to him dampened any enthusiasm that I had in the matter, and from then on until quite a later date Fidelity Glass Company passed out of any interest in the machine.

A little later, Mr. Travis, who was my predecessor in the Fidelity Glass Company, in conjunction with Mr. Baldwin of the Thatcher Manufacturing Company, obtained a non-exclusive right to use the machine, which later was made an exclusive right.

I often think that if a personality or type different from Mr. Ritchie had accompanied me to Toledo, history, so far as I am concerned, might have been different.

Yours very truly,

Dear Henry:

Like the little boy whose aunt praised him for some cleverness and who could not resist a repetition, fishing for additional compliments, I find myself back writing you another letter.

There is an old couplet that gives an account of the famous battle that was lost because of a horseshoe nail. The point of the couplet is that great events frequently turn upon trivial matters. I have always believed that a heavy wind and a very cold day was the cause of the location of the Owens plant at Clarksburg, W. Va., instead of in the meadows between Newark and Jersey City.

George W. Yost, of Bellaire, Ohio, and myself were commissioned by the then organizing Owens-Eastern Bottle Company to seek a location for the new plant. We reasoned, and after events proved the soundness of the reasoning, that New York City was destined to be not only a large user of bottles, particularly in the medicinal line, but also a point where large bottle buying would occur. We weighed the value of natural gas in connection with the location at some point in West Virginia, as against the close adjacency to a big market that the meadows between Newark and Jersey City afforded. We had in mind that natural gas, no matter in what abundance it appeared, was a passing phase while coal would always be reasonably available. We discussed this at various times at great lengths, and we two visited the meadows and finally took an option on a piece of ground the size of which I do not now recall, but it would have been large enough for any future developments. Practically all the major coal roads in the eastern part of the country have terminals in the New Jersey meadows, which seemed to give an assurance that coal would always be available. We were further influenced in the matter of the particular location we finally decided upon from the fact that it was planned to put a tunnel under the river, which later developed and is now a reality. This, we reasoned, would make truck deliveries into New York City a simple matter.

We further reasoned that our adjacency to the New York market would be such that any competing company getting into that market would have a serious problem to contend with. That was our thought at that time, but later developments incline me to believe that that would not have been such an important factor as at the time it seemed to be.

We called a meeting of the directors to meet in New York City. As I recall, there were present Mr. Owens, Mr. Walbridge, Mr. Boshart, Mr. Dudley Whitney, Mr. C. J. Yost, Mr. Shumacher, Mr. George W. Yost and myself. We engaged machines to take us to view the property. It may be that there have been more windy days and colder days than this was, but I doubt it. The wind was blowing a hurricane and the temperature must have been considerably below zero. On that part of the meadows where we were, there were no buildings so that the wind had a clear sweep and the force was such that it was almost impossible to make progress against it. We beat into the wind as best we could and finally found protection behind one of the large billboards that clutter up these meadows, which was at a point probably one-quarter of a mile from the property we wanted to look at. Mike was disgusted, in fact all of us were suffering. A heavy blast took off the hat of Mr. Shumacher and it never was found. Mike's blew off and in the hasty grab for it, while recovering it, it was a crushed and ruined hat. I doubt whether any of the party tried to say anything; at least I did not hear anything for some time. It was so cold and so windy that probably if anybody did say anything the words froze or the wind blew them away before they could be heard, but Mike's voice was heard. "To hell with this," said he. The decision was made then and there, without any discussion. Mike said "To hell with it" and that was the end.

On the ride back, without any meeting of the Board, Mike said, "You two fellows get to West Virginia and find a place," so we landed at Clarksburg.

I have often thought of what might have happened had the day been a nice balmy one like many I have seen at this very same spot. The location had much to commend it, and we had prepared a very good story to sell the idea to the others, but Mike's statement, "To hell with it," settled that.

Yours very truly,

Dear Henry:

Mr. Doss Taylor was, for quite a number of years, manager of the H. J. Heinz Company glass plant at Sharpsburg, Pa. The father of Doss had been a glass factory manager and Doss had been raised to the purple. Doss was, and in fact still (as this is penned) is, as he lives at Bowling Green, Ohio, an odd character. To those who did not know him his mannerisms were unendurable, and even to those who knew him, hardly bearable.

He, however, was a very good glass factory man and knew considerable about how to manage a glass factory both in the hand blown days and later in the machine era. He early saw the possibilities in the Owens machine for producing bottles for the H. J. Heinz Company and that company was among the first to install the machines, which it did at the Sharpsburg, Pa., plant.

Mr. Taylor would come frequently to Toledo, and generally head for the office of Mr. Walbridge, take off his coat, and sometimes even his shoes, throw himself down on a couple of chairs and sprawl out for the day. His first salutation would be, "How is the old son of a B. this morning?" He, undoubtedly, bored Mr. Walbridge to the limit.

He was in constant hot water with everybody in the Owens Bottle Company because of his constant complaining about the cost of repair parts. I think their license agreement required them to purchase repair parts, and these Taylor would try to prove were charged them beyond a reasonable price.

The general attitude of Doss towards the whole Owens outfit then was an idea that he was a bottle man and the Owens people were not, and that Owens knew nothing about bottles while he knew everything.

All of the above is preliminary to telling you a little story, the humor of which would not be so apparent unless you had this background.

Doss was released by the Heinz Company. He always had some interest in the Pittsburgh Clay Pot Company and a close relationship with the H. L. Dixon Company, in connection with which he would make more or less frequent trips to Toledo. On most of these trips he would spend considerable time with Mr. Owens, not always affording Mr. Owens very much pleasure in the meetings, but it was hard to shame Doss or to get him to understand that his absence was more acceptable than his presence.

Some years ago the Harbauer Company began to figure that we were charging them just as much for bottles as we charged others, and that we had no freight to pay, for which reason they felt that they should have a price lower than others; at least by the

amount of the freight. Mr. Clarence Brown, who was then general manager of the Owens Bottle Company, was inclined to agree with Mr. Harbauer, while Mr. Boshart had to oppose him.

Harbauer decided that he would build a bottle factory and make his own bottles. Mr. Dixon came to Toledo, accompanied by Mr. Taylor. Because of the fact that both offices were close to each other, there was apparently some fear that Mr. Owens would note the fact that Mr. Dixon was in the office of Mr. Harbauer, and to guard against this, Mr. Taylor managed to be in Mr. Owens' office and kept him occupied all the time Mr. Harbauer was negotiating for the building of the plant.

Some little time later Mr. Owens learned of these circumstances and he awaited the opportunity to say some things to Doss Taylor that were virtually unprintable.

Along about this time I spent an evening with Mr. Owens at the Secor Hotel. About five-thirty he and I were playing pool. A tailor in one of the rooms upstairs sent for Mike to fit some suits that Mike had ordered and Mike left me to hold the table until he would be back, which he said would be not more than ten minutes. While he was gone, who should walk into the pool room, where there was nobody at the time but myself, but Doss Taylor. I realized that if Mike came in while Doss was there, there would be some kind of trouble, and I started to tell Doss that Mike was due to be in in a moment or two, and I thought it might be better for him to get out of the way. While I was telling Doss this, Mike came in. When Mike saw Doss, I thought Mike would have his heart failure right then. He walked straight for Doss, called him a by-name and immediately Doss punched Mike, landing on his eye, and Mike punched immediately back, landing on Doss's nose, and when I got between them, I held them at arms' length. It was a ridiculous situation, as I was very much taller and very much larger than either of them and they were both striking past me at each other. I finally shoved Doss out of the room, quieted Mike and a little while later he and I left the hotel together. Mike had his electric car parked nearby and we started out to Mike's home, Mike naturally still very much excited. As we started to turn the corner the car stalled in the middle of the street and we got out. Mike gave a policeman $5 to push the car up along the curbstone, and we ate dinner at the hotel.

Doss never met Mike after that.

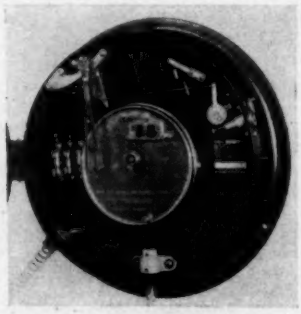
Yours very truly,

(To be continued in an early issue)

Rotax Electric Controller

Rotax stands for Rotating Contacts. These commutator type contacts are the outstanding features of the new electrically operated control instrument developed recently by the Foxboro Company of Foxboro, Mass.

According to the maker's announcement the development of this new contact marks a turning point in contact controller design.



It is claimed that the commutator type contact gives more accurate control—that it allows uninterrupted pen travel—that it gives positive contact at all times with a minimum of arcing and that it can be set from outside the case.

This instrument is used to control temperature, pressure, humidity, flow, or liquid level and to give audible or visible signals. It is designed to operate valves, compressors, blowers, motors, heating units of all kinds, horns, lights and other electrical equipment.

It has a wide variety of industrial applications. A representative cross-section of these include such processes as: temperature control of annealing ovens and furnaces, baking ovens, drying ovens, pressure control of gas lines, air lines or any other fluid; humidity control of drying ovens, storage rooms, and air conditioning equipment.

The instrument is so designed that it is possible to use a simple, positive lockup type of relay in the circuit. The contacts carry only the relay load. Flexibility of design permits various combinations of commutators so that special signaling or control problems may be met. If it is desirable to control time, a special time cycle feature may be added. Further information on the construction or uses of this new device may be had by writing to the Foxboro Company.

Preliminary Census Report on Glass for 1931

The Bureau of the Census announced September 21 that, according to a preliminary tabulation of data collected in the Census of Manufactures taken in 1932, the total value (at f. o. b. factory prices) of glass and glassware produced in the United States in 1931 amounted to $207,044,914, a decrease of 30.9 per cent as compared with $299,717,063 reported for 1929, the last preceding census year. The more important items which contributed to the total for 1931 are as follows: Polished plate glass, 88,046,775 square feet, valued at $26,110,693; window glass, 268,272,159 square feet, $10,397,396; tableware and ovenware, $13,403,743; blown tumblers, stem ware, and bar goods, $7,844,429; shades, globes, and other gas and electric goods (except electric bulbs and insulators), $6,591,265; milk bottles, 2,053,889 gross, $9,724,738; narrow-neck blown bottles (packers' ware), 2,783,986 gross, $8,842,566; wide-mouth blown bottles and jars (packers ware), 6,268,582 gross, $17,456,808; fruit jars (home-pack), 2,082,185 gross, $15,103,062; beverage containers, 3,986,915 gross, $15,411,812; non-pressure containers, $2,563,177; medicinal and toilet preparation containers, 12,061,882 gross, $29,222,569; general-purpose containers, 1,048,194 gross, $6,109,002.

This industry, as defined for census purposes, embraces establishments engaged wholly or principally in the manufacture of glass and glassware from the raw material. (Those establishments which are engaged in beveling, bending, engraving, staining, or ornamenting purchased glass, or in the manufacture of glassware from purchased "blanks," are to be classified later in the report on "Mirrors and other glass products made of purchased glass.")

Bob Landrum Rejoins the Harshaw Chemical Company

Robert D. Landrum, recently announced his resignation as general manager of the Ceramic Materials Division of The Titanium Alloy Manufacturing Company and that he has again become connected with the Harshaw Chemical Company and expects from now on to come in closer contact with the glass industry than heretofore. Mr. Landrum is a well-known chemical engineer, a graduate of the Rose Polytechnic Institute of Terra Haute, Ind. After graduation he spent several years in the enameling and stamping industry, then became the assistant professor of chemistry at the University of Kansas, where he remained from 1907-1910. He also served with several enameling concerns, and from 1914 to 1922 was chemical engineer and manager of the Service Department of the Harshaw Fuller and Goodwin Company, manufacturers of industrial chemicals. He was vice-president of the Vitreous Enameling Company and Vitreous Steel Products Company for several years and became general manager of the Ceramic Materials Division of the Titanium Alloy Manufacturing Company in 1925, which position he has just resigned. Mr. Landrum is a prominent member of the American Ceramic Society and has served that organization in many important capacities as trustee, vice-president, president, and more recently was made a Fellow of the Society. He is also a member of a number of other American and foreign organizations interested in chemistry. His return to the glass industry will give pleasure to his many friends in this field.

The hearing at Washington on fluorspar previously set by the United States Tariff Commission for October 20, 1932, has been postponed until December 8, 1932.

Important News of Glass Division Fall Meeting

Chairman Tillotson's announcement of September 1 to members, referred to below, has been followed by a later one, September 26, from Secretary Jack H. Waggoner, accompanied by a map showing how to reach the Woodmont Rod and Gun Club near Hancock, Md., by motor or on the B. & O. R. R. Those who arrive by rail should send advance notice to Mr. Waggoner, at Mellon Institute, Pittsburgh, Pa., of their time of arrival at Hancock and a car will be sent to convey them to the club. The club will be open to the Division members on Friday afternoon, October 7, and reservations for Friday evening dinner should be filed in advance with Mr. Waggoner.

Chairman E. Ward Tillotson of the Glass Division of the American Ceramic Society announced on September 1 that arrangements have been made to meet on the week-end of October 8, at the Woodmont Rod and Gun Club near Hancock, Md. The club's charge will be $3.50 per day, including meals, and the club can accommodate comfortably about twenty-five persons.

For those who are not acquainted with this place, let it be known that it is primarily a hunting preserve; it is "in the woods" away from civilization and on the bank of the Potomac River (an inland Cove Point so to speak). Needless to say, coats are not required in the dining room.

Many will recognize that this is in the midst of the glass sand mining territory, and it is planned that visits will be made to one or more of the adjacent properties, probably on Saturday afternoon. Because of the limited capacity of the club it is desirable that those who wish to stay there make their reservations as soon as possible with Secretary Jack H. Waggoner, Mellon Institute, Pittsburgh, Pa. Any "overflow" will have to be taken care of in the nearby towns of Hancock or Berkeley Springs.

The club is easy of access, being about five miles west of Hancock, on the National Pike (U. S. No. 40). A small map has been prepared which shows the region in some detail and provides a guide for those who are coming. The camp is equipped with radio, piano, horseshoes, fishing tackle, and it will not be necessary to bring blankets.

Corning Glass Drills for Gas

Announcement was recently made that the Corning Glass Works, Corning, N. Y., are having a test for gas drilled on the Ellery E. Callahan farm, Ferenbaugh, N. Y., on the Post Creek Road. Since the beginning of the present period of activity in this central New York field, this is the closest point to Corning at which gas tests have been made. David B. Regar, formerly state geologist for West Virginia is the geologist for the test.

Information Wanted

Anyone having knowledge as to the name or address of the maker of glass tiles marked "C. T. Co." made perhaps 20 years ago will confer a favor by communicating with A. H., care THE GLASS INDUSTRY, 2 Duane street, New York.

August Production of Polished Plate Glass

The total production of polished plate glass by the member companies of the Plate Glass Manufacturers of America, as reported by Secretary P. A. Hughes, for the month of August, 1932, was 1,773,470 sq. ft., as compared to 2,733,549 sq. ft. produced by the same companies in the preceding month, July, 1932, and 6,088,326 sq. ft. produced by the Association members in the corresponding month last year, August, 1931.

Commissioner Lincoln Dixon's Death

Lincoln Dixon, United States Tariff Commissioner, of Indiana, died on September 16 at Lyndon, Ky. He was appointed to membership on the Tariff Commission by President Coolidge in January, 1927, reappointed by President Hoover in September, 1930, and again reappointed in June, 1931, for the term to expire in 1937.

Inquiries Received

For further information address THE GLASS INDUSTRY

580. We desire to get in touch with manufacturers of animal glass eyes in quantities of 500 gross, at frequent intervals.

PERFORMANCE talks

532.38 Tons of Opal Glass
melted in this tank
in 263 working days

This remarkable record was made by the Inland Glass Co., Chicago, using Laclede-Christy SUPERFLUX Blocks.

Here are the facts, supplied by Mr. Karl Uhrman, Supt.:

Tank originally started up on . . 4/25
Tank shut down 10/14
Tank again started up 12/1
Tank finally closed down 4/23

263 working days — 532.38 tons of opal glass melted.

Your own plant conditions and practices may be different from those at Inland, but at any rate, here is a record to shoot at. If you are ready now to close down a tank for repairs, write, wire or phone us regarding a quotation or shipment on either of our two famous brands — Superflux or Buckeye.

LACLEDE-CHRISTY, ST. LOUIS, U.S.A.

P3

SUPERFLUX BLOCKS
A LACLEDE-CHRISTY PRODUCT

Current Prices of Glass-Making Materials

September 22, 1932

Quotations furnished by various producers, manufacturers and dealers.

Acid		Carlots	Less Carlots
Citric (dom.)	lb.	..	.29
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	..	.23½
Alcohol, denatured	gal.	..	..
Aluminum hydrate (Al (OH)$_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.15½
Ammonia water (NH_4OH) 26° drums	lb.	..	..
Antimony, metallic (Sb)	lb.	.02½	.02¾
Antimony oxide (Sb_2O_3)	lb.	..	.09½
Antimony sulphide (Sb_2S_3)	lb.	..	.08½
Arsenic trioxide (As_2O_3) (dense white), 99%	lb	.04	.14 .04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	..
Barium hydrate (Ba(OH)$_2$)	lb.	..	.05¼
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	..	.07¼
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7.10H_2O$)	lb.	..	.02¼-.02¾
Granulated	In bags, lb.	.02	.02½-.02¾
Powdered	In bags, lb.	.02¼	..
Boric acid (H_3BO_3)	In bags, lb.	.04¼	..
Cadmium sulphide (CdS)—			
Red	lb	..	.65-.90
Orange	lb	..	.60-1.10
Yellow	lb		1.30-1.50
Chromium oxide (Cr_2O_3)	lb	.18½	.19
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	1.25-1.45
In 10 lb. tins	lb	.	1.35
Copper oxide			
Red (Cu_2O)	lb.	..	.25
Black (CuO)	lb	..	.17-.19
Black prepared	lb	..	.22
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb	.09	.09½
Synthetic (Artificial)	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb		..	1.15-1.20
*Feldspar—			
100 mesh	ton	11.50-17.50	12.00-18.00
80 mesh	ton	11.00-11.50	13.00
40 mesh	ton	10.75-11.00	12.00
20 mesh	ton	9.50-11.00	..
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	30.00	..
In bags or barrels	ton	34.00	39.00
Imported	ton	30.00-31.00	33.00-37.00
Formaldehyde	lb.	..	.07
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb	..	.0425
Black (FeO)	lb	.04½	..
Kaolin (f.o.b. mine)	ton	8.00-9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00

*Spot Shipments.

Kryolith (see Cryolite)		Carlots	Less Carlots
Lead chromate ($PbCrO_4$)	lb.	..	.20
Lead oxide (Pb_3O_4) (red lead)	lb.	.059	.07
Litharge (PbO)	lb.	.049	.06
Lime—			
Hydrated (Ca(OH)$_2$) (in paper sacks)	ton	5.50	..
Burnt (CaO) ground, in bulk	ton	5.00	..
Burnt, ground, in paper sacks	ton	7.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	..
Limestone ($CaCO_3$)		1.50-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.27
Magnesium carbonate ($MgCO_3$)	lb.	.06	.10
Manganese 85% (MnO_2)	lb.	.03	.03
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¼
Ground	lb	11	.12
Potassium carbonate—94-96%	lb.	.0555	.0555
Calcined (K_2CO_3) 96-98%	lb.	.06¼	.07
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.25
Potassium hydrate (KOH) (caustic potash)	lb	.07¼	.08
Potassium nitrate (KNO_3) (gran.)	lb	..	.06-.06¼
Potassium permanganate ($KMnO_4$)	lb.	.16½	.17½
Powdered blue	lb.	..	1.35
Rochelle salts, bbls.	lb.	..	.14
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb	..	1.70
Silver nitrate (AgNO$_3$)	(100 oz.) per oz	..	.20¼-.20¾
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb	1.05	..
In barrels	Per 100 lb.	1.38	1.90-2.13
In bags	Per 100 lb.	1.17½	1.72½-1.92½
Spot orders	.025 per 100 lbs. higher	..	..
Sodium bichromate ($Na_2Cr_2O_7$)	lb	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.50	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb	..	3.62
95 per cent.	Per 100 lb.	1.67-177	1.72-1.82
Sodium selenite (Na_2SeO_3)	lb	..	2.00
Sodium fluosilicate (Na_2SiF_6)	lb	.05½	.06
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50-1.55
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb	3.45	3.80-4.00
Flowers, in bags	Per 100 lb	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb	3.35	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb	.37½	.39
Tin oxide (SnO_2) in bbls.	lb.	.28	.29½
Uranium oxide (UO_3) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	..	2.75
Yellow	lb	..	1.50
Zinc oxide (ZnO)	lb.	.08½	.12
American process. Bags	lb	.05¾	.06
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude. Gran. (Milled .005-.02c higher)		03¼	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS Corrected to Aug. 22, 1932		July 1931 Quantity	July 1931 Value	July 1932 Quantity	July 1932 Value	Seven Months Ending July 1931 Quantity	Seven Months Ending July 1931 Value	Seven Months Ending July 1932 Quantity	Seven Months Ending July 1932 Value
Glass and glass products (Total)		.....	$505,424	.....	$316,279	.....	$4,503,687	.....	$2,559,015
Plate and window glass—									
Window glass, common, box 50 sq. ft.		420	1,901	141	862	4,712	24,954	971	6,091
Plate glass, unsilvered, sq. ft.		248,897	69,194	183,279	55,396	2,517,975	766,860	1,927,192	541,996
Other window and plate glass	lbs.	122,328	10,168	163,388	17,993	1,829,859	193,986	726,824	89,519
Glass containers (bottles, vials and jars)		.....	129,993	.....	96,562	.....	1,245,219	.....	679,781
Table glassware, plain		.....	63,200	.....	50,118	.....	551,294	.....	315,699
Table and other glassware, cut or engraved		.....	7,838	.....	2,392	.....	53,224	.....	25,862
Lamp chimneys and lantern globes	lbs.	.....	7,236	.....	3,273	.....	62,221	.....	38,493
Globes and shades for lighting fixtures	lbs.	.....	25,772	.....	18,282	.....	260,140	.....	132,680
Chemical glassware	lbs.	13,896	14,670	7,683	7,219	90,408	90,926	62,959	58,090
Electrical glassware, except for lighting	lbs.	107,177	6,907	54,383	2,693	1,010,923	65,860	570,279	26,556
Other glassware		.....	105,545	.....	61,489	.....	1,126,003	.....	644,248
IMPORTS Corrected to Aug. 22, 1932									
Glass and glass products		.....	$498,722	.....	$240,914	.....	$4,503,247	.....	$1,847,364
Cylinder, crown, and sheet—									
Plain	dut. lb.	690,464	26,482	254,245	7,620	5,113,859	196,355	1,877,835	62,144
Bent, beveled, colored, etc.	dut. lb.	87,985	15,029	70,874	7,956	1,153,155	154,325	442,161	86,740
Plate glass	dut. sq. ft.	487,424	81,612	75,256	23,449	3,131,974	820,689	846,437	168,476
Glass mirrors		143	515	28	139	953	2,399	3,470	2,939
Rolled, cylinder, crown, and sheet glass, ground, obscured, bent, beveled, colored, etc.		.....	16,693	.....	2,283	.....	46,141	.....	47,130
Laminated glass and manufactures, and plated glass		.....	1,945	.....	76	.....	15,201	.....	3,191
Bottles, vials, jars, and other containers		.....	43,606	.....	22,983	.....	290,770	.....	183,573
Scientific articles and utensils	dut.	.....	39,419	.....	25,075	.....	228,193	.....	168,739
Tubes and rods	dut.	.....	12,846	.....	3,611	.....	73,636	.....	41,631
Illuminating articles	dut.	.....	28,722	.....	18,873	.....	217,230	.....	114,211
Blown glass articles—									
Bulbs for electric lamps, without filament	dut.	907,937	8,244	873,586	6,187	8,145,368	77,305	7,324,259	60,175
Other blown glass articles	dut.	.....	144,415	.....	78,149	.....	797,075	.....	499,745
Pressed glass articles		.....	9,490	.....	7,688	.....	68,835	.....	61,249
Other glassware		.....	69,704	.....	36,825	.....	505,093	.....	347,411